The Real Exchange Rate Fluctuations Puzzle: Evidence For Advanced And Transition Economies

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Abstract

This paper tries to analyze the sources of the real exchange rate fluctuations for a set of advanced economies and Central and Eastern European transition economies. To address this, in a first step, we compute two measures of the share of the variance of the real exchange rate accounted for movements in the relative prices of traded goods between the countries. One measure is based on R^2 coefficient and the other one is based on the mean-squared error (MSE) of the changes in the real exchange rate. In a second step, we estimate structural (identified) vector autoregression (SVAR) models, and decompose real and nominal exchange rate movements into those caused by real and nominal shocks. In a third step, we complete previous ones with an impulse-response analysis. Three central messages are derived from results: (1) for transition economies, under regimes of managed nominal exchange rates, the relative price of non-traded goods explain a large percentage of the variance of the real exchange rate; (2) there is evidence of instability in the variance decomposition of the real exchange rates for advanced economies across samples, and (3) as result of diverse fiscal and monetary policies in transition economies, real exchange rates in some economies are driven mostly by real shocks while in others are driven mostly by nominal shocks.

1.0 Introduction

Recent empirical literature on real exchange rate fluctuations for advanced economies has focused mainly on three approaches: the analysis of the real exchange rate volatility, the computation of several measures of the share of the variance of the real exchange rate and the variance decomposition analysis. In this context, from papers based on the two former approaches, the empirical evidence suggests that real exchange rates movements could be explained by the relative price of traded goods between countries, so the non-traded component of the real exchange rate accounted for little of the movements in the real exchange rate (Engel, 1993; Rogers and Jenkins, 1995; Engel 1999; Engel and Rogers, 2000). This result provides evidence in favor of sticky price models (Dornbusch, 1976) where nominal shocks would explain the real exchange rate fluctuations.

However, from papers based on the relative importance of real and nominal shocks for explaining the variance of the real exchange rate –the variance decomposition analysis– results suggest that fluctuations in real and nominal exchange rates are due to primarily to real shocks. Thus, real shocks dominate nominal shocks for both exchange rate series over short and long frequencies (Lastrapes, 1992; Enders and Lee, 1997). This empirical evidence would have an implication to model the exchange rates: models focused on the properties of price levels would be adequate (Balassa, 1964; Samuelson, 1964).

On the other hand, recent empirical papers for transition economies try to explain the strong real exchange rate appreciation observed in a number of transition economies during the, so called, transition period: following a sharp initial depreciation, real exchange rates have continuously appreciated over the course of transition (Halpern

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and Wyplosz, 1997; Begg et al. 1999). Part of this literature is focused on testing the Balassa-Samuelson effect in these economies (Halpern and Wyplosz, 2001; Broeck and Sl∅k, 2001; Égert, 2002). These papers suggest, in general, that there is a clear evidence in favor of productivity-based exchange rate movements –in favor the Balassa-Samuelson effect– in the European Union accession countries. This evidence would imply that real shocks may be the main force to explain movements in the real exchange rate.

However, other papers suggest that the similar path followed by the real exchange rate in transition economies is surprising given the differences in monetary and real shocks in different countries (Brada, 1998; Desai, 1998; Dibooglu and Kutan, 2001). This approach is based on the experience of all transition economies with respect to productivity growth, traded liberalization and capital inflows has not been the same. Moreover, the very different fiscal and monetary policies among the transition economies suggests that monetary shocks could dominate over productivity shocks in both frequency and intensity. Thus, not only real shocks but nominal shocks too could explain the real exchange rate movements in transition economies during the transition period.

The central lesson from this previous literature is that there is a mixed empirical evidence on explaining the sources of real exchange rate fluctuations in advanced and transition economies. Thus, this paper tries to give some light on what we could call the real exchange rate fluctuations puzzle. In other words, the main goal of this paper is to analyze the sources of real exchange rate fluctuations for a set of advanced economies during the full period 1973:1 to 2000:1, distinguishing the subperiods from 1973:1 to 1990:12 and from 1991:1 to 2000:1 (the transition period), and for a set of selected Central and Eastern European transition economies, during the transition period.

To address this, we follow three steps. In a first step, we compute two measures of the share of the variance of the real exchange rate accounted for movements in the relative prices of traded goods between the countries. One measure is based on R^2 coefficient and the other one is based on the mean-squared error (MSE) of the changes in the real exchange rate. In a second step, we estimate structural (identified) vector autoregression (SVAR) models, and decompose real and nominal exchange rate movements into those caused by real and nominal shocks. In this step we try to identify the main forces that explain the behavior of the real exchange rate in advanced and transition economies. In a third step, we complete previous ones with an impulse-response analysis.

The final goals of the empirical analysis from these three steps are to compare results on the sources of real exchange rates movements between samples for advanced economies, between advanced and transition economies during the transition period from plan to market and, finally, to derive some implications on how to model the exchange rates.

The remainder of the paper is organized as follows. Section 2 presents our theoretical starting point, describes the data set and reports the empirical results on real exchange rate fluctuations in three subsections: the R^2 coefficient and MSE measures, the variance decomposition analysis and the impulse-response analysis. Section 3 concludes the paper.

2.0 Explaining the Variance of the Real Exchange Rate

In this section we develop the analysis of the sources of fluctuations in the real exchange rate in three steps. Firstly, we compute two measures of the share of the variance of the real exchange rate accounted for movements in the relative prices of traded goods between the countries. Secondly, we estimate SVAR models, and decompose real and nominal exchange rate movements into those caused by real and nominal shocks. Thirdly, we use the impulse-response analysis to study the effects of a shock to an endogenous variable on the variables in the SVAR.

Our theoretical starting point is to decompose the real exchange rate in two components: the relative price of traded goods between countries and a weighted difference of the relative price of non-traded to traded goods prices in each country. Let p_t the log of a general price index for a country:

$$p_t = (1-a)\,p_t^T + a p_t^{NT} \tag{1}$$

where p_t^T is the log of traded goods price index, p_t^{NT} is log of the non-traded goods price index and *(1-a)* and *a* are the weights on traded and non-traded goods in the general price index, respectively. Similarly, the foreign general price index can be written as

where *(1-b)* and *b* are the weights on traded and non-traded goods in the general price index in the foreign country, respectively. If s_t denotes the log of nominal exchange rate, the real exchange rate could be written as

$$p_t^* = (1-b)p_t^{T*} + bp_t^{NT*} \tag{2}$$

$$q_t = s_t + p_t^* - p_t = (s_t + p_t^{T*} - p_t^T) + b(p_t^{NT*} - p_t^{T*}) - a(p_t^{NT} - p_t^T) \tag{3}$$

$$q_t = q_t^T + z_t \tag{4}$$

or, similarly, as

where

$$q_t^T = (s_t + p_t^{T*} - p_t^T)$$
$$z_t = b(p_t^{NT*} - p_t^{T*}) - a(p_t^{NT} - p_t^T)$$

If from equation (4) we obtained that movements in the real exchange rate are explained by the relative price of traded goods between countries, q_t^T, this result would imply that models focus on nominal exchange rate determination in a framework of sticky prices (sticky price disequilibrium models) would be a good approximation to model exchange rates. In other words, nominal shocks would cause the short-run excess volatility in exchange rates (Dornbusch, 1976). On the other hand, if we obtained that movements in the real exchange rate are explained by the relative price of non-traded to traded goods prices in each country, this result would suggest that we could model the exchange rates using models based on the properties of price levels. Thus, real shocks would play a central role to explain the real exchange rate fluctuations (Balassa, 1964, Samuelson, 1964).

To carry out our empirical analysis, we use three data sets. The first data set are quarterly data of the gross domestic product deflator, the consumer price index, the aggregate producer price index and end of period nominal exchange rates for Canada, Japan, United Kingdom and United States, from 1973:1 to 2000:1, and for the Euro Zone, from 1982:1 to 2000:1. In particular, we construct the general real exchange rate from the gross domestic product deflator and we use a crude approximation to traded an non-traded goods prices: the producer price index as proxy of traded goods prices, and construct the relative price of traded goods between countries from it, and the consumer price index as proxy of non-traded goods prices.

The second data set are monthly data of the consumer price index, the food consumer price index, the services consumer price index and end of period nominal exchange rates, for a set of advanced economies. In particular, for Canada, Japan and United States the sample size covers the period from 1973:1 to 2000:1, for all time series. For France and Italy, from 1973:1 to 1998:12 for all series. For Germany from 1973:1 to 1998:12 for all series, except for the services consumer price index that covers from 1976:1 to 1998:12, and for United Kingdom from 1973:1 to 2000:1 for all series, except for the services consumer price index that covers the period from 1975:1 to 2000:1. We construct the general real exchange rate using the consumer price index. Moreover, we use a better approximation to traded and non-traded goods prices: the food price index as proxy of traded goods prices, and construct the relative price of traded goods between countries from it, and the services price index as proxy of non-traded goods prices.

The third data set are similar to previous one but for a selected set of Central and Eastern transition economies. In particular, the series cover the period from 1991:1 to 2000:1, the transition period, for Czech Republic, Hungary, Poland and Romania, and from 1991:12 to 1999:12 for Slovenia[1]. As in previous data set, we construct the general real exchange rate from consumer price index and consider the food price index as proxy of traded goods prices and the services price index as proxy of non-traded goods prices.

The data have been obtained from the OECD database, in particular, from the Main Economic Indicators database for all countries, except for the aggregate quarterly data for the Euro Zone that have been obtained from the Eurostat database, particularly, from Eurostatistics.

2.1. The R^2 and MSE Measures

In this subsection, we compute two measures of the share of the variance of the real exchange rate, q_t , due to the relative price of traded goods between countries, q_t^T . The first one is a very simple measure based on the R^2 coefficient from the ordinary least square regression on the changes of q_t on q_t^T at four different horizons.

The second measure is based on the MSE of the change in the real exchange rate[2]. We try to compute how much of the MSE of changes of q_t is attributable to changes in q_t^T , at four different horizons. In particular, we use the next decomposition

$$\frac{MSE(q_t^T - q_{t-n}^T)}{MSE(q_t^T - q_{t-n}^T) + MSE(z_t - z_{t-n})} \tag{5}$$

$$MSE(q_t^T - q_{t-n}^T) = \mathrm{var}(q_t^T - q_{t-n}^T) + \left[mean(q_t^T - q_{t-n}^T)\right]^2 \tag{6}$$

where the MSE is defined as the sum of the square drift and the variance,

with

where *N* is the sample size and *n* is the horizon.

$$mean(q_t^T - q_{t-n}^T) = \frac{n}{N-1}(q_N^T - q_1^T)$$

$$\mathrm{var}(q_t^T - q_{t-n}^T) = \frac{N}{(N-n-1)(N-n)} \sum_{j=1}^{N-n}\left[q_{j+n}^T - q_j^T - mean(q_{j+n}^T - q_j^T)\right]^2$$

We have obtained the empirical results regarding the simple R^2 measure at four different horizons, for the full sample, 1973:1-2000:1, and for the subsamples 1973:1-1990:4 (or 1990:12 for monthly data) and 1991:1-2000:1[3]. Results are presented for all ten possible bilateral relationships between the advanced economies Canada, Japan, Euro Zone, United Kingdom and United States, using quarterly data and employing the crude approximation to traded and non-traded goods prices: the aggregate producer price index and the consumer price index,

[1] These countries have been selected depending on the data availability.
[2] See Engel (1999).
[3] All the numerical results of this subsection are available upon request.

respectively. Results suggest that average R^2 values for horizons of 1 quarter, 2 quarters, 4 quarters and 12 quarters are 0.95, 0.94, 0.94 and 0.92, respectively, for the full sample. Similar results are obtained for the two subsamples.

In addition, we have obtained the values of R^2 measure for the advanced economies Canada, France, Germany, Italy, Japan, United Kingdom and United States, using a better approximation to traded and non-traded goods prices: the food price index and the services price index, respectively. We observe that, for example, the average value of the R^2 measure is 0.86 for horizon 1, during the subperiod 1973:1-1990:12 while for the transition period it increases to 0.93. It would suggest some evidence in favor of a more important role of sticky prices in the subsample 1991:1-2000:1. In other words, this result intuitively would suggest that nominal shocks are more important in the period 1991:1-2000:1 for advanced economies.

Finally, the results of R^2 measure for transition economies Czech Republic, Hungary, Poland, Romania and Slovenia, during the transition period, show that the relative prices of non-traded goods would explain the movements in the real exchange rate in a greater percentage than in advanced economies.

These preliminary results are confirmed when the measure of the share of the variance of the real exchange rate, attributed to movements in the traded real exchange rate based on the MSE, is used. Results for advanced economies suggest that, in general, using the crude approximation to traded and non-traded goods, q_t^T explains the majority of the variance of q_t, during the full sample and subsamples. However, using monthly data, we observe that, for the full sample and subsample 1973:1-1990:12, the relative price of non-traded to traded goods prices plays some role to explain the movements in q_t . For example, it could be observed in the MSE measure values of the bilateral relationships between Canada and United States, Germany and France, Japan and Canada, Japan and the three Euro Zone countries and those bilateral relationships that include to United Kingdom. However, when we analyze the transition period from 1991:1 to 2000:1, q_t^T causes the majority of the variance of q_t .

Finally, we obtain the measure of the share of the variance of the real exchange rate attributed to movements in the traded real exchange rate based on the MSE, for transition economies. We observe the results change strongly: in general, the relative prices of non-traded goods explain much more than in advanced economies. Then, it would suggest an important result: in these economies, under managed nominal exchange rates, the relative prices of non-traded goods could explain for 50% to 70% of the variability of the real exchange rate. For example, for the bilateral relationship between Czech Republic and United States we observe that the relative prices of non-traded goods cause the 50%, 51%, 57% and 70% for 1, 6, 12 and 36 months, respectively, of the variability of the real exchange rate.

In summary, two central messages are derived from this first approximation to explain the fluctuations in the real exchange rate: (1) for advanced economies, using the food and services price indexes as proxies of traded and non-traded goods prices, respectively, we observe that the relative price of traded goods explain the majority of the variance of the real exchange rate for the transition period. In other words, it looks as if the nominal shocks play a much more central role during the transition period than along the full sample and subsample 1973:1-1990:4 (or 1990:12 for monthly data). (2) For transition economies, the evidence would suggest that under regimes of managed nominal exchange rates, the relative price of non-traded goods explains a large percentage of the variance of the real exchange rate.

2.2. The Variance Decomposition Analysis

In this subsection we estimate structural (identified) vector autoregression SVAR models, and decompose real and nominal exchange rate movements into those caused by real and nominal shocks. In this step, we try to identify the main forces that explain the behavior of the real exchange rate in advanced and transition economies, and compare it between them during the transition period from plan to market.

We assume that there are two types of shocks affecting nominal and real exchange rates. The first shock has effect on both exchange rates and we will call it real shock. The second one, that we will call nominal shock, has no long-run effect on real exchange rate. This assumption is consistent with the notion of long-run money neutrality. Thus, the real shock affects the real and nominal exchange rate while the nominal shock affects the nominal exchange rates, but it has transitory but no permanent effect on real exchange rate. Then, the neutrality restriction forces real shock to explain all the variance of real exchange rate at an infinitive forecast horizon, so we are interested on explanatory power of real and nominal shocks over short horizons. This assumption allows us to identify the model and decompose the exchange rate series. The two disturbances are uncorrelated at all leads and lags.

We present now the joint process followed by the real exchange rate, q_t, and nominal exchange rate, s_t, for advanced economies[4]. We will call to this empirical model the SVAR(q_t , s_t) model. In addition, as nominal exchange rates are managed during transition period for transition economies, we will compute the decomposition on real exchange rates and prices levels, instead of nominal exchange rates, for transition economies[5]. We will refer to this empirical model as the SVAR(q_t , p_t) model. As series are non-stationary in levels, stationary in differences[6] and are no cointegrated series, using the Johansen's (1988, 1992) cointegration methodology[7], then a bivariate autoregression model in first differences is adequate.

Let u_{rt} and u_{nt} denote the real and nominal shocks in *t*, respectively. Since the vector of the first differences in real and nominal exchange rates $x_t \equiv [\Delta q_t, \Delta s_t]'$ is stationary, it has the next bivariate moving average representation,

$$x_t \equiv [\Delta q_t, \Delta s_t]' = C(L)u_t \tag{7}$$

$$\begin{bmatrix} \Delta q_t \\ \Delta s_t \end{bmatrix} = \begin{bmatrix} C_{11}(L) & C_{12}(L) \\ C_{21}(L) & C_{22}(L) \end{bmatrix} \begin{bmatrix} u_{rt} \\ u_{nt} \end{bmatrix} \tag{8}$$

or, similarly

where Δ is the first-difference operator and $C_{ij}(L)$, for *i*,*j*=1,2, are polynomials in the lag operator, *L*. To identify the shocks, we have assumed that nominal shocks have no long-run effect on the real exchange rate. In terms of equation (8), this restriction is equivalent to impose that the sum of coefficients in $C_{12}(L)$ sum to zero. Thus, where $c_{12}(k)$ is the *kth* coefficient in $C_{ij}(L)$.

The empirical model in equation (8) is completed for each transition economy by introducing a dummy variable to capture the effects on endogenous variables of changes in the exchange rate regimes during the transition period.

$$\sum_{k=0}^{\infty} c_{12}(k) = 0 \tag{9}$$

Finally, we carry out our empirical analysis for advanced economies from 1973:1 to 2000:1, and for the subperiods 1973:1-1990:4 (or 1990:12 for monthly data) and 1991:1 to 2000:1, and for transition economies for the period 1991:1 to 2000:1. Moreover, we calculate the real exchange rates taking to United States as reference country

[4] See Blanchard and Quah (1989), Lastrapes (1992) and Enders and Lee (1997).
[5] As Dibooglu and Kutan (2001) suggest.
[6] The results on unit root analysis, based on the Dickey-Fuller and Phillips-Perron unit root tests, are available upon request.
[7] Cointegration results are available upon request. We notice that there is only a marginal evidence of cointegration between real and nominal exchange rates for Italy when monthly data are used.

for advanced economies, and we calculate real exchange rates for transition countries taking as reference country not only to United States but to Germany too.

Empirical results on variance decomposition analysis are reported in Tables 1 to 3. Table 1, panel (a), shows the results of variance decomposition of real and nominal exchange rates for advanced economies, for the full sample 1973:1 to 2000:1, using quarterly data, and taking to United States as the reference country to construct the real exchange rates. As we can observe, for Canada real shocks cause almost all of forecast error variance of the real exchange rate. It occurs at any forecast horizon. Moreover, nominal shocks explain about 10% of the variance of nominal exchange rate at a 1 quarter forecasting horizon, but it falls about 5% after one quarter. Results suggest that for the full sample real shocks explain almost all the variance of real and nominal exchange rates. Similar results are obtained for the Euro Zone, although the evidence shows that nominal shocks are a bit more important than in Canada to explain the variance of the real exchange rate. For example, nominal shocks explain about 21% of the forecast variance of real exchange rate at a horizon of 12 quarters. For Japan real shocks dominate to nominal shocks, but the evidence suggests that nominal shocks play an important role to explain the variance of the nominal and real exchange rates over short horizons. Finally, for United Kingdom the real shocks look to cause almost all the variance of the real exchange rate, and nominal shocks explain a substantially part of the variance of the nominal exchange rate. Similar results are obtained for the subperiod 1973:1-1990:4 (Table 1, panel (b)).

For the subperiod 1991:1 to 2000:1, the evidence from Table 1 panel (c) changes substantially. In general, for all economies nominal shocks play a central role to explain the variance, not only of the real exchange rate but the nominal exchange rate too. In particular, nominal shocks dominate to real shocks to explain the variance of the real exchange rate for Canada, Japan and United Kingdom. For the Euro Zone nominal shocks explain, for example, about 30% of the variance of the real exchange rate at a 12 quarters forecasting horizon. In addition, nominal shocks dominate to real shocks to cause the variance of the nominal exchange rate for Canada at any horizons (except for one quarter), for Japan at 8 and 12 quarters forecasting horizons, and for United Kingdom over short forecasting horizons.

Table 2 illustrates the results of the variance decomposition analysis for advanced economies, using monthly data. From panels (a) and (b) results hardly differ from previous ones: we observe that, for all countries, real shocks look to cause almost all forecast error variance of the real and nominal exchange rates. Results for the transition period are reported in panel (c). We notice that the importance of nominal shocks increases substantially to explain the variance of the real and nominal exchange rates. In particular, for Canada we observe that nominal shocks dominate to real shocks and they cause almost all the variance of the real and nominal exchange rates. For example, nominal shocks explain about 85% of the variance the real exchange rate at a horizon of 1 month and this percentage increases about 95% at an horizon of 9 months. For France, nominal shocks explain a large percentage of the variance of the real exchange rate and are central to explain the variance of the nominal exchange rate at any horizon. For Germany, nominal shocks explain an important percentage of the variance of the real exchange rate, overall, in short run horizons. Similar results are obtained for the nominal exchange rate. Finally, for Italy, Japan and United Kingdom the importance of the nominal shocks increases by comparison with the full sample and subsample 1973:1-1990:12, but it is weaker than in Canada, France and Germany. In general, for Italy nominal shocks explain somewhat more of the variance of the real exchange rate at 12, 24 and 36 horizons, and for Japan and United Kingdom nominal shocks explain somewhat more of the variance of the real exchange rate at short horizons.

In summary, results using quarterly data suggest that for the full sample and subsample 1973:1-1990:4 real shocks cause almost all of the variance of the real exchange rate for Canada, Euro Zone and United Kingdom, and for Japan real shocks dominate to nominal shocks but nominal shocks explain an important part of the variance of the real and nominal exchange rates, over short horizons. However, for the transition period nominal shocks are central to explain the variance of the real and nominal exchange rates. On the other hand, results using monthly data suggest that, for the full sample and the subsample 1973:1-1990:12, for all countries, real shocks cause almost all forecast error variance of the real exchange rates while for the transition period the importance of nominal shocks increases substantially to explain the variance of real exchange rates.

From the evidence of the variance decomposition analysis of the real and nominal exchange rates for advanced economies we derive several central messages: (1) the evidence suggests that, in general, for the full sample and subsample 1973:1-1990:4 (or 1990:12 for monthly data) real shocks play a central role to explain the movements of the real exchange rate, so changes in the real exchange rate would be dominated by real shocks. Nominal shocks are lightly more important for explaining the forecast variance of nominal exchange rates; (2) for the transition period, results suggest that a large proportion of real exchange rates movements is due to nominal shocks; (3) these results suggest evidence in favor of instability in the variance decomposition of real exchange rates across samples. In other words, the sources of fluctuations of exchange rates depend on the sample that we consider. It would have a clear implication for modelling exchange rates in advanced economies. For the period 1973:1 to 1990:4 (or 1990:12 for monthly data) real shocks look to dominate nominal shocks and then, this result would suggest that models that emphasize the importance of real shocks to explain the sources of fluctuations of the real exchange rate, such as the Balassa's (1964) and Samuelson's (1964) models, would be adequate. However, for the subperiod 1991:1 to 2000:1, in general, nominal shocks play a central role to explain fluctuations in exchange rates, so the sticky price models, such as Dornbusch's (1976) model, would be more adequate to model the exchange rate behavior.

Table 3 presents the results of the variance decomposition analysis for transition economies, during the transition period from 1991:1 to 2000:1. The analysis has been done from our empirical model in equation (8) but using the real exchange rate and the price levels as endogenous variables, the SVAR(q_t , p_t) model. We take to United States and Germany, alternatively, as reference countries to construct the real exchange rates.

Table 3 illustrates results for the SVAR(q_t , p_t) model where United States is the reference country. The dummy variable that capture the specific regime changes in each transition economies, has been significant only for Hungary and Romania. Results suggest that for Czech Republic real shocks dominate the changes in the real exchange rates. For example, real shocks explain about 79% of the variance of the real exchange rate at a 1 month forecasting horizon. Moreover, nominal shocks explain almost all the error variance of prices levels, although its importance decreases along the horizons. The results are similar for Hungary: real shocks explain almost all the variance of the real exchange rate, overall, over short horizons. For example, real shocks explain 97% of the variance of the real exchange rate at an horizon of 1 month. Nominal shocks cause a large percentage of the variance of the prices over short horizons. However, results change from previous ones for Poland. We observe that nominal shocks dominate real shocks to explain the variance of the real exchange rate at short horizons. For example, nominal shocks explain about 73% of the variance of the real exchange rate at an horizon of 1 month. However, prices are dominated by real shocks at short horizons. For Romania results show as changes in the real exchange rate are dominated by nominal shocks over short horizons. For example, nominal shocks explain about the 92% of the variance of the real exchange rate at a 1 month horizon. However, real shocks look to explain almost all of the variance of prices. Finally, for Slovenia results show a clear dominance of real shocks to explain the variance of the real exchange rate. In addition, if we consider to Germany as reference country to construct the real exchange rates[8], results hardly differ from previous ones: for Czech Republic, Hungary and Slovenia real shocks mostly explain the fluctuations of the real exchange rate while nominal shocks are the main force to explain the fluctuations in the real exchange rates for Poland and Romania[9].

[8] Results are available upon request.

[9] Results regarding the SVAR (q_t , s_t) model for transition economies are available upon request. The real exchange rate results do not differ from the SVAR (q_t , p_t) model. In particular, for Czech Republic, Hungary and Slovenia real shocks explain a large percentage of the forecast error variance of the real exchange rate, while nominal shocks are the main force to explain the fluctuations of the real exchange rate for Poland and Romania. In addition, real shocks dominate nominal shocks to explain the variance of the nominal exchange rate in Romania. For the Czech Republic results show that real shocks explain almost all of the variance of the nominal exchange rate at any horizon. For Hungary real shocks explain the variance of the nominal exchange rate over short horizons. However, nominal shocks dominate real shocks to explain the variance of the nominal exchange rate, over short horizons, for Poland. Finally, real shocks dominate nominal shocks to cause the movements in the nominal exchange rate in Slovenia. However, these results could be affected for the managed nature of the nominal exchange rates during the transition period.

In short, two central messages could be derived from the variance decomposition analysis carried out for transition countries: (1) the sources of fluctuations of the real exchange rates depend on the transition economy considered. In particular, real shocks explain mostly the movements in the real exchange rates for Czech Republic, Hungary and Slovenia while nominal shocks play a central role to explain the variance of the real exchange rate for Poland and Romania. Thus, our results give support to previous literature (Brada, 1998; Desai, 1998; Dibooglu and Kutan, 2001) that suggests that as result of diverse fiscal and monetary policies, real exchange rates in some accession economies could be driven mostly by real shocks and in others could be driven mostly by nominal shocks. So, these results suggest that different monetary and fiscal policies in transition economies imply different results from the variance decomposition analysis. (2) From this analysis we could derive implications for modelling the real exchange rate in transition economies. For Czech Republic, Hungary and Slovenia real shocks dominate and it would suggest models such as Balassa's (1964) and Samuelson's (1964) models would be adequate. Thus, during the transition period, as consequence of transformation of sizable industrial sectors, whose capital stocks have proven largely obsolete, these economies have presented an important increase of the productivity growth in their industrial sectors, along the transition from plan to market. It could explain the strong appreciation of real exchange rate in these transitions economies. However, nominal shocks would explain mainly the movements in the real exchange rates for Poland and Romania, so disequilibrium models would be adequate to model the real exchange rate. Thus, it looks that monetary policy has had an important role in influencing the real exchange rate in Poland and Romania.

2.3. Impulse-Response Análisis

In this subsection, we use the impulse-response analysis to study the effects of both types of shocks on the endogenous variables in the SVAR models. In general, we observe several features:

1. For advanced economies, during 1973:1 to 2000:1[10] using quarterly data, Figure 1 (available from the author), panel (a), shows that there is evidence of a smooth increase in the real and nominal exchange rates in response to a real shock. For the transition period, Figure 1, panel (b), nominal shocks look to cause an immediate increase in the real exchange rate, with strong evidence in favor of overshooting in Canada.
2. For advanced economies, during the full period[11] and using monthly data, results in Figure 2 (available from the author) are similar to pervious ones: real shocks cause a smooth increase in the real and nominal exchange rates. Moreover, nominal shocks cause an unnoticeable effect on real exchange rates, thus, there is no evidence of overshooting. However, during the transition period, nominal shocks tends to cause, in general, an increase on real exchange rates: there is some evidence of overshooting.
3. For transition economies, in general, the real exchange rate raises due to a real shock. For the Czech Republic and Poland real exchange rate depreciates smoothly in response to a nominal shock. For Romania we observe a more important depreciation of the real exchange rate in response to a nominal shock. Thus, for these accession economies there is evidence in favor of overshooting.

3. Concluding Remarks

This paper has analyzed the sources of real exchange rate fluctuations for a set of advanced economies and Central and Eastern transition economies. The central messages derive from the results suggest that:

1. For advanced economies, previous empirical evidence, that support that fluctuations in the real exchange rate are explained by the relative price of traded good between countries, does not hold for transition economies: under regimes of managed nominal exchange rates, the relative price of non-traded goods explains an high percentage of the variance of the real exchange rate.
2. There is evidence in favor of instability in the variance decomposition of the real exchange rates across samples for advanced economies. In other words, the sources of fluctuations of the real exchange rates depend on the sample that we consider: for the period 1973:1 to 1990:4 (or 1990:12 for monthly data) real shocks look to dominate nominal shocks and for the period 1991:1 to 2000:1, in general, nominal shocks

[10] Similar results are obtained for the subperiod 1973:1-1990:4.
[11] Similar results are obtained for the subperiod 1973:1-1990:12.

play a central role to explain fluctuations in exchange rates. This result would imply that models that emphasize the importance of real shocks to explain the sources of fluctuations of the real exchange rate, would be more adequate for the subsample 1973:1-1990:4 (or 1990:12 for monthly data), while sticky price disequilibrium models would be more adequate for the transition period.

3. As result of diverse fiscal and monetary policies in transition economies, real exchange rates in some economies are driven mostly by real shocks while in others are driven mostly by nominal shocks. 🕮

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Table 1: Variance Decomposition of Real and Nominal Exchange Rates

Advanced Economies[a]			
	(a) Sample 1973:1-2000:1[b] (quarterly data)	(b) Sample 1973:1-1990:4[b] (quarterly data)	(c) Sample 1991:1-2000:1 (quarterly data)

	RER[c]		NER[c]		RER		NER		RER		NER	
CAN												
Horizon	u_r[d]	u_n[e]	u_r	u_n	u_r	u_n	u_r	u_n	u_r	u_n	u_r	u_n
1	99.14	0.85	90.20	9.79	82.68	17.31	97.45	2.54	77.00	22.99	92.96	7.039
2	98.67	1.32	95.05	4.94	75.58	24.41	93.70	6.29	28.05	71.94	39.20	60.79
3	97.51	2.48	96.78	3.12	73.82	26.17	91.32	8.67	17.38	82.61	22.15	77.84
4	93.08	6.91	97.87	2.12	76.11	23.88	92.07	7.92	16.43	83.61	19.16	80.83
8	98.24	1.75	96.37	3.62	85.41	13.85	92.57	7.42	32.31	67.68	34.07	65.92
12	98.80	1.19	97.49	2.50	89.39	10.60	93.96	6.03	34.21	65.78	35.68	64.31
EZ												
Horizon	u_r	u_n	u_r	u_n	u_r	u_n	u_r	u_n	u_r	u_n	u_r	u_n
1	95.43	4.56	97.44	2.55	93.76	6.23	91.78	8.21	92.71	7.28	89.86	10.13
2	97.12	2.87	98.72	1.27	88.77	11.22	86.58	13.41	84.90	15.09	80.47	19.52
3	96.33	3.66	98.63	1.36	88.25	11.74	86.08	13.91	77.94	22.05	75.38	24.61
4	95.30	4.69	98.26	1.73	89.08	10.91	86.99	13.00	78.50	21.49	76.24	23.75
8	84.91	15.08	91.43	8.56	91.00	8.99	89.36	10.85	73.65	26.63	71.19	28.80
12	78.95	21.04	87.50	12.49	89.69	10.30	88.35	11.64	69.84	30.15	67.94	32.05
JAP												
Horizon	u_r	u_n	u_r	u_n	u_r	u_n	u_r	u_n	u_r	u_n	u_r	u_n
1	56.51	43.48	67.63	32.36	63.83	36.16	74.99	25.00	33.37	66.62	51.17	48.82
2	56.42	43.57	69.21	30.78	57.74	42.25	71.39	28.60	33.60	66.39	54.25	45.74
3	60.69	39.30	74.66	25.33	61.49	38.05	75.78	24.21	44.27	55.72	51.34	48.65
4	63.49	36.50	77.87	22.12	65.84	34.15	79.92	20.07	44.37	55.62	51.24	48.75
8	70.87	29.12	84.24	15.75	74.51	25.48	87.95	12.04	39.82	60.17	42.63	57.36
12	75.29	24.70	87.94	12.05	76.63	23.36	88.20	11.79	32.87	67.12	33.50	66.49
UK												
Horizon	u_r	u_n	u_r	u_n	u_r	u_n	u_r	u_n	u_r	u_n	u_r	u_n
1	74.21	25.78	56.68	43.31	52.91	47.08	30.53	69.46	28.85	71.14	43.56	56.92
2	80.72	19.27	65.39	34.60	63.29	36.70	42.49	57.50	26.32	73.67	47.89	52.10
3	83.43	16.56	67.07	32.92	68.17	31.82	44.85	55.14	26.32	73.67	43.38	56.61
4	85.87	14.12	69.02	30.97	72.79	27.20	47.81	52.18	34.36	65.63	46.34	53.65
8	83.25	16.74	61.99	38.00	70.88	29.11	43.09	56.90	78.67	21.32	77.12	22.87
12	82.59	17.40	60.17	39.82	71.40	28.59	42.73	57.26	82.43	17.56	81.29	18.70

Notes

a. CAN: Canada, EZ: Euro Zone, JAP: Japan, UK: United Kingdom.

b. Sample period for the Euro Zone: 1982:1-2000:1.

c. RER: real exchange rate, NER: nominal exchange rate.

d. Percentage of forecast error variance accounted for by real shocks.

e. Percentage of forecast error variance accounted for by nominal shocks.

Table 2: Variance Decomposition of Real and Nominal Exchange Rates

Advanced Economies[a]			
	(a) Sample 1973:1-2000:1[b] (monthly data)	(b) Sample 1973:1-1990:12[b] (monthly data)	(c) Sample 1991:1-2000:1 (monthly data)

	RER[c]		**NER[c]**		**RER**		**NER**		**RER**		**NER**	
						CAN						
Horizon	u_r [d]	u_n [e]	u_r	u_n	u_r	u_n	u_r	u_n	u_r	u_n	u_r	u_n
1	98.36	1.63	85.21	14.78	97.90	2.09	82.70	17.29	15.15	84.84	31.86	68.13
3	99.24	0.75	86.65	13.34	98.20	1.79	80.24	19.75	8.71	91.28	22.63	77.36
6	99.43	0.56	86.09	13.90	96.26	3.73	74.17	25.82	5.15	94.84	17.20	82.79
9	99.56	0.43	87.58	12.41	97.04	2.95	74.60	25.39	4.75	95.26	15.90	84.09
12	99.24	0.75	90.85	9.14	98.00	1.99	79.24	20.75	5.50	94.49	14.12	85.87
24	99.27	0.72	92.88	7.11	98.88	1.11	82.46	17.53	13.85	86.14	22.25	77.74
36	99.52	0.47	93.43	6.56	99.12	0.87	83.63	16.36	17.99	82.00	26.90	73.09
						FRA						
Horizon	u_r	u_n	u_r	u_n	u_r	u_n	u_r	u_n	u_r	u_n	u_r	u_n
1	96.76	3.23	99.12	0.87	99.50	0.49	97.28	2.71	56.28	43.71	61.65	38.35
3	98.52	1.47	99.49	0.50	97.68	2.31	93.18	6.81	62.34	37.65	67.63	32.36
6	99.24	0.75	98.89	1.10	92.18	7.81	86.29	13.70	55.02	44.97	60.66	39.33
9	98.81	1.18	97.48	2.51	87.14	12.85	80.90	19.09	43.47	56.52	48.96	51.03
12	99.07	0.92	97.74	2.25	87.86	12.13	81.69	18.30	29.70	70.29	33.49	66.50
24	99.51	0.48	98.03	1.96	90.00	9.99	83.62	16.37	27.32	72.67	30.19	69.80
36	99.66	0.33	98.13	1.86	91.18	8.81	84.78	15.21	26.89	73.10	28.81	71.18
						GER						
Horizon	u_r	u_n	u_r	u_n	u_r	u_n	u_r	u_n	u_r	u_n	u_r	u_n
1	86.32	13.67	78.79	21.25	99.86	0.13	99.67	0.32	50.29	49.70	41.11	58.88
3	82.61	17.38	73.38	26.61	99.38	0.61	97.08	2.91	51.97	48.02	42.15	57.84
6	80.83	19.16	70.65	29.34	98.54	1.45	95.22	4.77	58.79	41.20	47.84	52.15
9	80.07	19.92	68.99	31.00	98.31	1.68	94.73	5.26	64.31	35.68	52.72	47.27
12	82.86	17.13	71.97	28.02	98.68	1.31	96.03	3.96	71.12	28.87	61.18	38.81
24	90.30	9.69	79.74	20.25	97.45	2.54	97.98	2.01	67.11	32.88	59.12	40.87
36	91.72	8.27	84.62	15.37	92.93	7.06	97.38	2.61	64.19	35.80	56.38	43.61
						ITA						
Horizon	u_r	u_n	u_r	u_n	u_r	u_n	u_r	u_n	u_r	u_n	u_r	u_n
1	99.97	0.02	97.97	2.12	80.37	19.62	67.29	32.70	97.17	2.82	98.76	1.23
3	99.83	0.16	96.57	3.42	79.69	20.30	63.29	36.07	98.15	1.89	99.34	0.65
6	99.87	0.12	97.04	2.95	81.13	18.86	65.12	34.87	96.96	3.03	98.66	1.33
9	99.91	0.08	96.97	3.02	81.33	81.66	65.79	34.20	91.74	8.25	94.88	5.11
12	99.92	0.07	97.12	2.87	82.48	17.51	67.53	32.46	85.07	14.92	89.05	10.94
24	99.92	0.07	96.04	3.95	83.59	16.40	69.29	30.70	82.96	17.03	86.97	13.02
36	99.88	0.11	94.88	5.11	83.46	16.53	69.74	30.25	78.70	21.29	82.42	17.57
						JAP						
Horizon	u_r	u_n	u_r	u_n	u_r	u_n	u_r	u_n	u_r	u_n	u_r	u_n
1	99.16	0.83	99.32	0.67	78.08	21.91	91.91	8.08	75.92	24.07	83.80	19.19
3	98.54	1.45	99.71	0.28	75.21	24.78	89.31	10.68	70.38	29.61	78.51	21.48
6	98.43	1.56	99.82	0.17	73.14	26.85	86.47	13.52	79.58	20.41	85.60	14.39
9	98.46	1.53	99.58	0.41	74.77	25.22	88.47	11.52	82.24	17.75	87.96	12.03
12	98.52	1.47	99.36	0.63	76.42	23.57	90.38	9.61	85.19	18.40	90.31	9.68
24	94.51	5.48	99.68	0.31	68.75	31.24	89.86	10.13	89.74	10.25	94.03	5.96
36	89.82	10.17	99.66	0.33	62.16	37.83	89.32	10.67	90.15	9.84	94.45	5.54
						UK						
Horizon	u_r	u_n	u_r	u_n	u_r	u_n	u_r	u_n	u_r	u_n	u_r	u_n
1	98.46	1.53	77.22	22.77	97.64	2.35	75.54	27.45	79.58	20.41	91.77	8.22
3	95.12	4.87	76.65	23.34	92.70	7.29	70.73	29.26	75.40	24.59	83.85	16.14
6	93.84	6.15	77.07	22.92	91.05	8.94	69.53	30.46	71.41	28.58	79.83	20.16
9	93.21	6.78	74.78	25.21	91.87	8.12	71.19	28.80	71.76	28.23	80.51	19.48
12	91.76	8.23	71.48	28.51	90.97	9.02	69.54	30.45	73.89	26.10	82.21	17.78
24	90.65	9.34	62.98	37.01	90.02	9.97	64.16	35.83	78.38	21.61	85.11	14.88
36	90.78	9.21	58.50	41.49	90.32	9.67	60.98	39.01	81.63	18.36	87.49	12.50

Notes

a. CAN: Canada, EZ: Euro Zone, JAP: Japan, UK: United Kingdom.

b. Sample period for the Euro Zone: 1982:1-2000:1.
c. RER: real exchange rate, NER: nominal exchange rate.
d. Percentage of forecast error variance accounted for by real shocks.
e. Percentage of forecast error variance accounted for by nominal shocks.

Table 3: Variance Decomposition of Real and Nominal Exchange Rates

Transition Economies[a] (USA reference country)
Sample 1991:1-2000:1[b] (monthly data)

	Real Exchange Rates		Prices	
CREP				
Horizon	u_r[c]	u_n[d]	u_r	u_n
1	78.88	21.11	2.80	97.19
3	78.20	21.79	5.23	94.76
6	79.75	20.24	18.10	81.89
9	77.39	22.60	27.58	72.41
12	77.34	22.65	37.54	62.45
24	76.92	23.07	58.35	41.64
36				
HUN				
Horizon	u_r	u_n	u_r	u_n
1	97.04	2.95	22.30	77.69
3	92.71	7.28	27.89	72.10
6	92.17	7.82	41.65	58.34
9	88.50	11.49	53.47	46.52
12	82.42	17.57	58.66	41.33
24	64.46	35.53	72.43	27.56
36	53.56	46.43	76.64	23.35
POL				
Horizon	u_r	u_n	u_r	u_n
1	27.03	72.96	98.92	1.07
3	47.25	52.74	97.50	2.49
6	61.44	38.55	96.60	3.39
9	66.05	33.94	90.31	9.68
12	70.60	29.39	81.47	18.52
24	70.00	29.99	60.39	39.60
36	66.70	33.29	55.30	44.69
ROM				
Horizon	u_r	u_n	u_r	u_n
1	7.56	92.43	56.75	43.24
3	26.82	73.17	91.67	8.32
6	33.58	66.41	97.16	2.83
9	34.86	65.13	98.37	1.62
12	35.41	64.58	97.99	2.00
24	59.46	40.53	92.93	7.06
36	60.29	39.70	93.38	6.61
SLOV				
Horizon	u_r	u_n	u_r	u_n
1	99.09	0.09	1.49	98.50
3	99.33	0.66	0.75	99.54
6	97.08	2.91	7.49	92.50
9	88.07	11.92	24.62	75.37
12	85.95	14.04	43.08	56.91
24	86.58	13.41	77.67	22.32
36	88.09	11.90	87.95	12.04

Notes.
a. CREP: Czech Republic, HUN: Hungary, POL: Poland, ROM: Romania,
b. SLOV: Slovenia.
c. Sample period for Slovenia: 1991:12-1999:12.
d. Percentage of forecast error variance accounted for by real shocks.
e. Percentage of forecast error variance accounted for by nominal shocks.